

WHAT IS CLAIMED IS:

- A1
1. A method for producing a carboxyl cationite, comprising the steps of:
 - (a) dissolving a monovinyl monomer and a cross-linking agent as co-monomers in a first solvent to form a first mixture, said first solvent being selected from the group consisting of a mixture of an organic solvent and water, a mixture of an organic solvent and acetic acid, and an aqueous solution of acetic acid wherein an amount of said acetic acid is in a range of from about 60% to about 100%, volume per volume; and
 - (b) adding an initiator of radical polymerization to said first mixture to form a swollen block of the carboxyl cationite, thereby obviating the need for dispersing the carboxyl cationite in a dispersing medium.
 2. The method of claim 1, wherein said first solvent is selected from the group consisting of a mixture of an organic solvent and water, and a mixture of an organic solvent and acetic acid, and said organic solvent is selected from the group consisting of dimethylformamide, monobutyl glycolate, polyethylene glycol and an alcohol.
 3. The method of claim 2, wherein said alcohol is selected from the group consisting of butyl alcohol, octyl alcohol and decyl alcohol.
 4. The method of claim 2, wherein said first solvent is said mixture of said organic solvent and said acetic acid, and wherein said acetic acid is present in an amount of from about 20% to about 50% volume per volume.
 5. The method of claim 1, wherein said first solvent is said aqueous solution of acetic acid, wherein said amount of said acetic acid is in said range of from about 60% to about 100%, volume per volume.
 6. The method of claim 5, wherein said monovinyl monomer is selected from the group consisting of a methacrylic acid, an acrylic acid and a methacryloylaminocarbonic acid.

7. The method of claim 6, wherein said monovinyl monomer is selected from the group consisting of methacrylic acid, acrylic acid, methacryloylcaproic acid, methacryloylaminobenzoic acid, methacryloylglycine and methacryloylaminocarbonic acid.

8. The method of claim 7, wherein an amount of said monovinyl monomer and an amount of said cross-linking agent are together in a range of from about 10 percent to about 30 percent weight per weight of said first mixture.

9. The method of claim 8, wherein said cross-linking agent is a long chain cross-linking agent.

10. The method of claim 9, wherein said long chain cross-linking agent is selected from the group consisting of hexahydro-1,3,5-triacryloyltriazine (HTA), N,N'-methylenediacrylamide (MDAA), N,N'-ethylenedimethacrylamide (EDMA), N,N'-hexamethylenedimethacrylamide (HMDMA), triallylisocyanurate (TAIC), *p*-phenylenedimethacrylamide (*p*-PHDMA), and benzidinedimethacrylamide (BDMA).

11. The method of claim 10, wherein said long chain cross-linking agent is selected from the group consisting of HTA, EDMA, and TAIC.

12. The method of claim 11, wherein said initiator is selected from the group consisting of ammonium persulfate, a 1,1' azobis (cyclohexanecarbonitrile), and a combination of ammonium persulfate - sodium methabisulfite.

13. The method of claim 12, wherein step (b) is performed at a temperature in a range of from about 20 to about 25 °C if said initiator is said combination of ammonium persulfate - sodium methabisulfite, or alternatively at a temperature in a range of from about 50 to about 60 °C if said initiator is ammonium persulfate or a 1,1' azobis (cyclohexanecarbonitrile).

14. The method of claim 1, further comprising the steps of:

- (c) crushing said swollen block of the carboxylic cationite to form particulate matter; and
- (d) washing said particulate matter.

15. The method of claim 14, wherein step (d) includes the steps of:

- (i) washing said particulate matter with water;
- (ii) washing said particulate matter with an aqueous solution of from about 0.5 N to about 1 N sodium hydroxide of pH 8;
- (iii) washing said particulate matter with an aqueous solution of about 1 N hydrochloric acid; and
- (iv) washing said particulate matter with water.

16. A method for forming particulate matter of carboxylic cationites, the method comprising the steps of:

- (a) dissolving a monovinyl monomer and a cross-linking agent as co-monomers in a first solvent to form a first mixture;
- (b) adding an initiator of radical polymerization to said first mixture to form a pre-polymer;
- (c) dispersing said pre-polymer in a solution of alcohol to form a dispersion mixture; and
- (d) mixing said dispersion mixture with an aqueous solution of an inorganic salt to form the particulate matter.

17. The method of claim 16, wherein an amount of said monovinyl monomer and an amount of said cross-linking agent are together in a range of from about 20 percent to about 30 percent weight per weight of said first mixture.

18. The method of claim 17, wherein said first solvent is selected from the group consisting of an aqueous solution of acetic acid and a mixture of an organic solvent with acetic acid.

19. The method of claim 18, wherein said first solvent is said aqueous solution of acetic acid, and said aqueous solution of acetic acid includes an amount of acetic acid in a range of from about 5 percent to about 15 percent volume per volume.

20. The method of claim 18, wherein said first solvent is said aqueous solution of acetic acid, and said aqueous solution of acetic acid includes an amount of acetic acid in a range of from about 60 percent to about 100 percent volume per volume.

21. The method of claim 18, wherein said first solvent is said mixture of said organic solvent and said acetic acid, and said acetic acid is present in an amount of from about 20% to about 50% volume per volume.

22. The method of claim 21, wherein said organic solvent is selected from the group consisting of dimethylformamide, monobutyl glycolate and polyethylene glycol.

23. The method of claim 22, wherein said alcohol is selected from the group consisting of butyl alcohol, octyl alcohol and decyl alcohol.

24. The method of claim 23, wherein a ratio of said pre-polymer to said alcohol is in a range of from about 2.5:1 to about 5:1.

25. The method of claim 23, wherein a ratio of said pre-polymer to said alcohol is about 1:1.

26. The method of claim 23, wherein a ratio of said dispersion mixture to said aqueous solution of said inorganic salt is in a range of from about 1:4 to about 1:5.

27. The method of claim 26, wherein said aqueous solution of said inorganic salt is an aqueous solution of sodium sulfate.

28. The method of claim 27, wherein an amount of said sodium sulfate in said aqueous solution of sodium sulfate is about 20 percent weight per weight.

29. The method of claim 16, wherein said monovinyl monomer is selected from the group consisting of a methacrylic acid, an acrylic acid and a methacryloylaminocarbonic acid.

A 30. The method of claim 29, wherein said monovinyl monomer is selected from the group consisting of methacrylic acid, acrylic acid, methacryloylcaproic acid, methacryloylaminobenzoic acid, methacryloylglycine and methacryloylaminocarbonic acid.

31. The method of claim 30, wherein said cross-linking agent is a long chain cross-linking agent.

32. The method of claim 31, wherein said long chain cross-linking agent is selected from the group consisting of hexahydro-1,3,5-triacryloyltriazine (HTA), N,N'-methylenediacrylamide (MDAA), N,N'-ethylenedimethacrylamide (EDMA), N,N'-hexamethylenedimethacrylamide (HMDMA), triallylisocyanurate (TAIC), *p*-phenylenedimethacrylamide (*p*-PHDMA), and benzidinedimethacrylamide (BDMA).

33. The method of claim 32, wherein said long chain cross-linking agent is selected from the group consisting of HTA, EDMA, and TAIC.

34. The method of claim 33, wherein said initiator is selected from the group consisting of ammonium persulfate, a 1,1' azobis (cyclohexanecarbonitrile), and a combination of ammonium persulfate - sodium methabisulfite.

35. A method for forming particulate matter of a carboxylic cationite, the method comprising the steps of:

- (a) dissolving a monovinyl monomer and a cross-linking agent as co-monomers in a first solvent to form a first mixture;
- (b) adding an initiator of radical polymerization to said first mixture to form a pre-polymer; and

- (c) dispersing said pre-polymer in an aqueous solution of an inorganic salt to form the particulate matter.

36. The method of claim 35, wherein said first solvent is selected from the group consisting of a mixture of an organic solvent and acetic acid, and an aqueous solution of acetic acid.

37. The method of claim 36, wherein said aqueous solution of acetic acid includes an amount of acetic acid in a range of from about 5 percent to about 15 percent volume per volume.

38. The method of claim 36, wherein said aqueous solution of acetic acid includes an amount of acetic acid in a range of from about 60 percent to about 100 percent volume per volume.

39. The method of claim 36, wherein an amount of said monovinyl monomer and an amount of said cross-linking agent are together in a range of from about 50 percent to about 70 percent weight per weight of said first mixture.

40. The method of claim 39, further comprising the step of:
(d) dispersing the particulate matter in a solution of alcohol.

41. A method for producing a carboxyl cationite, the method consisting essentially of the steps of:

- (a) dissolving a monovinyl monomer and a cross-linking agent as co-monomers in a first solvent to form a first mixture; and
(b) adding an initiator of radical polymerization to said first mixture to form a swollen block of the carboxyl cationite.

42. The method of claim 41, wherein said first solvent is selected from the group consisting of a mixture of an organic solvent and water, a mixture of an organic solvent and

acetic acid, and an aqueous solution of acetic acid wherein an amount of said acetic acid is in a range of from about 60% to about 100%, volume per volume.

43. The method of claim 42, further comprising the step of:
(c) crushing said swollen block to form particulate matter.
44. The method of claim 43, further comprising the step of:
(d) washing said particulate matter.

[illegible]